

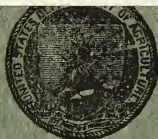
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U. S. DEPARTMENT OF AGRICULTURE
MISCELLANEOUS CIRCULAR 12

A HANDBOOK
FOR
BETTER FEEDING
OF LIVESTOCK

Rev.ed.
follows



ISSUED FEBRUARY, 1924 :: :: REVISED NOVEMBER, 1925

TEN POINTS IN BETTER FEEDING

“MAKE EVERY POUND OF FEED YIELD A PROFIT”

1. GROWING ANIMALS make best use of feed—keep them growing.
2. WEANING TIME is a critical period; start feeding before weaning.
3. BALANCED RATIONS supply animals' needs with least feed.
4. WATER and SALT should always be accessible.
5. LEGUMES, PASTURES, and SUCCULENT FEEDS aid production and profit.
6. FEED LIBERALLY for large production; mere maintenance yields no profit.
7. BREEDING ANIMALS should be kept thrifty, not overfat.
8. GOOD FEEDING EQUIPMENT prevents waste of feed and labor.
9. PARASITES, EXPOSURE, and OVERCROWDING retard growth and waste feed.
10. FEED COSTS are important; not all balanced rations yield equal profit.

“GOOD BREEDING HELPS FEED BRING BEST RESULTS”

If you want help with a specific feeding problem, obtain a “Feeding-Question Sheet.”

Ask your State Agricultural College, your county extension agent, or address Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

A HANDBOOK FOR BETTER FEEDING OF LIVESTOCK

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PART I.—HELPS IN EVERYDAY FEEDING PROBLEMS

IMPORTANCE OF A GOOD CROPPING SYSTEM

The advantages of a good cropping system for the farmer who is feeding several classes of livestock under average farm conditions can not be too greatly emphasized. Those crops that can be grown cheaply and well on his own farm usually constitute the most economical feeds that the livestock feeder can use. Furthermore, a carefully worked-out cropping system will provide for the maximum amount of good pasture, one of the greatest aids to successful feeding of livestock.

SELECTING ANIMALS FOR FEEDING

The selection of good animals is important, whether they are to be fed for market or kept on the farm. The best feeders are strong, healthy animals of quiet disposition and good breeding. In cattle especially, and to some extent in other animals, feeding capacity is usually indicated by the appearance of the animals, as shown by general thriftiness, condition of hair, brightness of eye, width of muzzle, strength of jaw, and the capacity of the barrel or paunch. Good teeth are of utmost importance in good feeding animals.

Be sure that the animal is adapted to the purpose for which you are feeding it. Do not expect a dairy-bred animal to produce a choice beef carcass.

Purebreds of good quality do better in the feed lot than scrubs or common stock. A canvass of livestock feeders throughout the entire country shows that purebreds make about 40 per cent greater returns for their owners than scrubs or common stock when fed in the same way. Crossbred and high-grade stock make excellent feeders, owing to the good breeding of the purebred stock back of them.

ATTENTION TO DETAILS PAYS

The wise stockman recognizes that careful attention to little details pays well in the end. The health and comfort of the

animals, their individual likes and temperaments, and many other things seemingly small, count for a great deal in successful feeding.

Rough treatment, excitement, and noise prevent the best results in feeding.

Other things being equal, the ration that is palatable is the one that will accomplish the best results; and yet many rations that are at first distasteful to animals may afterwards become highly palatable if the animal is given an opportunity to become accustomed to them.

Many animals like a little variation in the ration now and then. Sudden changes in feed are objectionable for all animals, but a little variation in the concentrate or roughage, or a change of pasture, will often be worth the trouble.

A successful feeder will carefully watch his animals, observe the comparative results of different rations and systems of feeding, and will learn much through experience and experimentation on his own farm.

SOME COMMON MISTAKES IN FEEDING

Reports received by the United States Department of Agriculture from several hundred livestock feeders in all parts of the country mention mistakes commonly made in feeding livestock. According to the reports, the principal ones, in order of prominence, are:

- Poor combinations of feed (forming improperly balanced ration).

- Underfeeding.

- Too little protein supplied in the ration.

- Failure to supply animals with sufficient water.

- Lack of legume pastures and hays.

- Abrupt changes in feeding.

- Poor housing for animals.

- Feeding animals infested with lice, mites, and other parasites.

- Failure to give animals sufficient salt and other minerals.

- Waste of feeds.

- Poor feeding equipment, lack of self-feeders, etc.

- Overfeeding.

- Irregularity of feeding.

It will be seen that the proper compounding of rations is given first importance, also that underfeeding is a much more common error than overfeeding.

SPECIAL REQUIREMENTS OF ANIMALS

Feeding experiments conducted in recent years have brought to light much new information regarding special requirements

of animals for certain food substances which may not be omitted from the ration without danger of serious harm to the animal. There has not been sufficient experimental work upon which to draw definite conclusions, but new information on the subject is being gradually acquired. Following is a brief summary of some of the special feed requirements as shown by the latest experiments:

PROTEIN MUST BE OF RIGHT KIND

Growing animals not only require an abundant supply of protein but the proteins must be of the right kind. Some proteins lack certain essential elements that may be supplied by other proteins. For example, experiments conducted at the Government experiment farm at Beltsville, Md., show that vegetable or plant proteins are not so valuable in an egg-laying ration for hens as animal proteins, such as meat scrap and fish scrap.

Until further studies have been made of the value of some proteins for supplementing others, a safe plan for livestock feeders to follow is to supply all the green pasture and succulence possible, and add as much variety to the ration as possible without making it too costly.

ABUNDANCE OF MINERAL MATTER IMPORTANT

An abundance of minerals in the ration is of greatest importance in the case of young growing animals and females carrying young, but minerals are necessary for animals of all ages and conditions. Mineral matter not only makes up the skeleton of the animal but it is found in all parts of the body.

Common salt, lime (calcium), phosphorus, and iodine are the minerals most commonly lacking.

Salt should be accessible to farm animals at all times, no matter what their ration.

Lime will often be deficient in the ration if it is made up principally of straw, roots, and the cereal grains and their by-products. Milk, skim milk, and buttermilk contain plenty of lime, while legume hays exceed all other farm-grown feeds in lime content. Lime in such a form as calcium phosphate or wood ashes (sifted to remove nails, etc.) may be added to the ration if it is thought lacking in lime.

Rations that contain protein enough usually contain plenty of phosphorus. Straws, beet pulp, potatoes, and molasses contain but little phosphorus. The cereals and their by-products are rich in this mineral. It can be supplied, if lacking, in the form of ground rock phosphate or ground bone, which also furnishes lime.

LACK OF IODINE CAUSES GOITER

In recent years in parts of the Northwestern States farmers have lost many newborn colts, calves, lambs, and pigs from a disease called goiter. In this disease the young are born weak or dead, and are often hairless, or have enlarged necks.

It has been found that this is caused by a lack of iodine in the ration of the dam, and the difficulty may be overcome by giving the pregnant dams potassium iodide in dilute form. Your local veterinarian, county agent, State agricultural col-



FIG. 1.—Salt should be kept before animals of all ages

lege, or the United States Department of Agriculture should be consulted when special problems of this nature are confronted.

VITAMINS NECESSARY FOR GROWTH AND HEALTH

Some of the recent feeding experiments with both human beings and animals have demonstrated that a ration to be satisfactory must contain certain compounds of unknown composition known as "vitamins." Lack of one or more of these vitamins may cause young animals to become stunted or may cause serious disease or death in both young and old animals.

For horses, cattle, and sheep, balanced rations containing plenty of good roughage are rarely deficient in vitamins.

Hogs are liable to become unthrifty if they are confined and fed on grains with little other feed. Poultry often receive rations low in the necessary vitamins. Feeders of hogs and poultry should provide plenty of variety in the ration, green feed whenever possible, and supplement the ration with dairy by-products, meat or fish scrap, or other feeds containing animal proteins.

PREPARING FEED FOR LIVESTOCK

GRINDING FEEDS

As a rule, it does not pay to grind, crush, or roll feed when the animals have good teeth and the grains are not small and unusually hard; but small, hard grains, like rye, wheat, barley, and kafir, should be ground or rolled.

Grains should be ground for very young lambs.

If the grinding is not too costly, it often pays to grind grain for horses at very hard work, high-producing dairy cows, and fattening cattle when there are no hogs following them.

SOAKING AND COOKING FEEDS

Soaking, steaming, or cooking feeds may slightly increase the digestibility, but usually not enough to pay for the expense and work involved. Cooking sometimes encourages animals to eat more feed, and this is desirable when maximum gains are required.

Milk from tuberculous cattle should be boiled (to kill the germs) before it is given to livestock, including poultry.

Potatoes should be cooked before they are fed, but not allowed to stand long before use, as molds are liable to develop.

SHREDDING AND CUTTING ROUGHAGES

Shredding fodder does not increase its feeding value, but it makes it easier to handle, and the cattle clean up shredded fodder more thoroughly than they do whole stalks. The refuse makes much better bedding than the whole stalks.

It rarely pays to cut or grind hay, except for horses doing very heavy work. If roughage is cut, it should not be made into a dusty meal.

MEASURING THE FEED

The careful feeder watches each animal and feeds according to the animal's needs. The safest way to do this properly is to have some way of measuring the feed.

If the feeder is using baled hay, or feed which has been weighed into sacks, it is easy to calculate how much is being given at each feeding. If using loose hay, the weight of an average forkful should be determined.

If feeding concentrates, the feeder can readily determine the weight of the contents of a measure. Weights and measures of the common feeds will be found on page 44.

UNDERFEEDING FARM ANIMALS

Many farm animals are underfed and therefore can not produce a profit on the feed they consume. This is an unwise and costly practice, as is also that of omitting necessary nutrients from an otherwise plentiful ration. For instance, a cow capable of giving a heavy flow of milk is underfed even though she receives all the ear corn and corn fodder that she can eat. Proper rations are given later.

The danger of underfeeding is greatest when wintering young, growing stock. They should always be kept growing during the winter.

OVERFEEDING FARM ANIMALS

Overfeeding is wasteful in several ways. Animals overfed may eat more than they need or can digest properly, and they may leave feed in their troughs which they will not eat later. They also may become sick and lose weight or go "off feed" for several days.

Old animals are more liable to be overfed than young ones. It is usually best to keep animals ready for a little more feed than they have been given.

NUMBER OF FEEDS PER DAY

Horses at hard work and dairy cows producing heavily should be fed three times a day. Young animals should be fed at least three times a day, and the intervals between feeds should be as nearly even as possible. Two feeds a day for other animals are usually sufficient.

REGULARITY OF FEEDING

A little attention to details in feeding and caring for animals sometimes counts for a great deal. Regularity of feeding usually repays the feeder for the added trouble.

RATIONS SHOULD NOT BE CHANGED ABRUPTLY

Sudden changes in a ration may throw an animal off feed. Although changes are often desirable or necessary, the new feeds should be begun a little at a time. In like manner, when

some feed is to be omitted from the ration, make the change gradually.

TO REDUCE DANGER OF BLOATING

To reduce danger of bloating, cattle and sheep should be given a good fill of dry feed, particularly roughage, before they are turned on green forage, such as red clover or alfalfa, for any length of time. If some dry roughage is convenient for them in the pasture they often correct, of their own accord, tendencies to bloat.

Dew and rain increase the danger of bloating.

Horses and hogs are not subject to bloating, but before being turned out on green forage for any length of time they should be gradually accustomed to the change. Since much stock is lost from bloating, owners should investigate this subject fully, depending on the crop to be fed. The department will furnish information on request.

IMPORTANT TO SUPPLY PLENTY OF WATER

Nothing can take the place of water. Be sure that it is clean and fresh and convenient to the animals. They may suffer from lack of water rather than go a long way for it, especially during very cold or very hot weather.

If horses, cattle, and sheep can get a good drink once or twice daily, they will do well. Hogs and poultry should have water much oftener, preferably close at hand, where they can drink whenever they want it.

TONICS AND CONDITION POWDERS

Healthy animals do not need tonics or condition powders. If a tonic is needed, the feeder should examine his methods. Plenty of good feed, fresh water, exercise, sunshine, pure air, with sanitary surroundings, should keep an animal in good health. If a tonic is desired, one of known composition may be mixed at home. The following formulas are suggested for all stock except hogs. (A mineral mixture for hogs is given on p. 33.)

FORMULA NO. 1

	Pounds
Glauber salt	2
Soda (baking)	1
Salt	1
Fenugreek	$\frac{1}{8}$
Linseed meal	25

FORMULA NO. 2

	Pounds
Glauber salt	5
Saltpeter	$1\frac{1}{2}$
Fenugreek	1
Gentian	2
Linseed meal	50

For horses a heaping tablespoonful of one of these mixtures fed with the grain three times a day is sufficient.

EQUIPMENT FOR FEEDING

Proper equipment, well arranged, saves feed and labor.

Grain and similar feeds should be kept in rat-and-mouse-proof cribs or bins. These rodents eat large quantities and waste still more.

Labor-saving devices, such as self-feeders and racks, are economical.

Where large numbers of livestock are fed it is usually advisable to use a wagon or an overhead carrier from the feed room or bin to the feed troughs or bunks. Silage may be fed in the same way.

Chutes from the haymow into or near the mangers save labor.

THE USE OF SELF-FEEDERS

The use of self-feeders is discussed in this handbook under feeding the different classes of animals. They are most useful in fattening hogs for market and in feeding chickens. They are great labor savers and are especially valuable when there is much farm work to do, for they can be filled at odd times and field work can go ahead with less interruption.

CREEPS FOR YOUNG ANIMALS

All young, growing animals should be given additional feed in creeps or pens adjacent to the pens or pastures in which they are running with their dams. The creeps are so constructed that the old animals can not gain entrance to them. Size of opening should be regulated by both width and height.

HARVESTING CROPS WITH LIVESTOCK

Crops may be harvested by livestock economically when the quantity trampled down and the injury to the soil does not exceed the cost of harvesting by hand. Harvesting by stock is most common with corn alone, or with corn and soybeans, cowpeas, or velvet beans. Poor stands of small grain, such as rye or barley, may also be harvested advantageously in this way. It is often good practice to harvest the best part of the crop before the stock is turned in.

Animals to be fattened by this method of feeding should be turned into the field first and later replaced by other stock when the crop is nearly harvested, to clean up what the fattening stock has left. It is necessary to give livestock a good supply of water when crops are harvested in this way.

UTILIZING FARM WASTES

Every livestock feeder should make a study of the conditions on his farm with the idea of feeding such products as are being wasted. Estimates show that annually more than \$100,000,000 worth of corn stover and straws are burned, plowed under, allowed to rot in stacks, or in other ways wasted in the United States. Great quantities of inferior hay, grain, and roughage for which there is no ready market may be fed with advantage to livestock.

By failing to clean their grain before marketing it, grain farmers haul to market each year much good livestock feed for which they get nothing, because it is sold as dockage. For example, in 1923 nearly 12,000,000 bushels of wheat screenings were produced, threshed, and marketed as dockage along with the wheat in the States of North Dakota, South Dakota, Minnesota, and Montana. The grain farmers got nothing for these screenings as dockage, but they would have been worth millions of dollars to them as feed for livestock. By means of cleaning machines the screenings can be removed at the thresher or granary at a cost of 2 or 3 cents a bushel. A good grade of wheat screenings is practically equal to oats in composition and feeding value. Fed to sheep with clover or alfalfa hay they are worth as much as good wheat. Cattle, hogs, and poultry also make good use of screenings as a part of their ration.

Cottonseed meal is often used as a direct fertilizer in sections where it is cheap. It is usually much more profitable to feed it to some kinds of livestock, as discussed later, and apply the manure on the land. Very little of the fertilizing value in cottonseed meal is lost through feeding.

Crops usually grown for human use, such as potatoes and peanuts, may be so plentiful and cheap as to warrant feeding the surplus to farm animals instead of placing it in storage.

The wise feeder soon learns that the proper use of all farm by-products, waste, and surplus crops for livestock feed often constitutes the main difference between profit and loss in feeding.

DANGER IN FEEDING DEAD ANIMALS TO LIVESTOCK

Feeding the carcasses of animals that have died of disease is a common source of infection to healthy stock. Experimentation has proved that healthy hogs may contract tuberculosis by eating chickens that died of the disease. The Bureau of Animal Industry investigated a case in which a large proportion of the hogs shipped from a certain ranch were found to

be tuberculous when examined at the packing house. It was learned that practically all the poultry on the farm had the disease and that it had been the custom at this place to throw all dead hens into the hog yard, where they were greedily eaten.

The safest manner of disposing of carcasses of animals is to burn them to ashes; the next safest way is to cover them with lime and bury them deeply. If a carcass is left on the ground, birds, dogs, and other animals may feed on it and spread disease and parasites over a wide area.

FEEDING MILK FROM TUBERCULOUS CATTLE

Milk from tuberculous cattle may spread the disease to any animals that drink the milk. It should never be fed unless heated to at least scalding temperature, or held at 145° F. for 30 minutes. To be certain of safety it is best, as a practical measure, to boil the milk.

IMPORTANCE OF KEEPING ANIMALS HEALTHY

Animals even of the finest breeding, although given the best feeds in correct proportions, do not make a profit for the feeder if they are not properly cared for and kept in good health. Disease, lice, worms, and various discomforts are means of wasting feed. Feeders who can not understand the poor condition of their animals when given good feeds should examine them carefully for ailments and remove the cause.

FEEDING EQUIPMENT SHOULD BE KEPT CLEAN

Feeding equipment, especially when feeding young animals, should be kept clean. If the animals are given more feed in their boxes or troughs than they will clean up before the next feeding, this stale feed, if left, will be wasted and will also cause part of the new feed to be wasted.

Pails for feeding calves, bottles and rubber nipples for feeding orphans, and other feeding utensils, if allowed to become dirty, may cause serious digestive troubles or permanent disease. Thorough cleaning and sterilization of the equipment will prevent this danger.

STOCK-POISONING PLANTS

Plants which are injurious to domestic animals are found in all parts of the United States, but the heaviest losses by poisoning occur on the western ranges. Larkspur, whorled milkweed, and loco weed are among the most destructive. Bulletins describing these plants and giving methods of treatment

for poisoned animals may be obtained from the United States Department of Agriculture.

IMPORTANCE OF DEHORNING AND CASTRATING

Cattle that are liable to be ill tempered may be more safely run with others of their kind, and are much less dangerous to handle, if they are dehorned. Cattle also do better in the feed lot if the horns have been removed. It is better to prevent growth of horns when the animal is young than to dehorn later.

Males that are to be fattened should be castrated. They will be much quieter, fatten better, produce a better quality of meat, and bring a higher price when sold.

KEEPING FEEDING RECORDS

Feeders of most classes of animals may profit by keeping feed and production records of their stock. Most successful dairymen keep a feed record and a milk record for each cow. This enables them to feed each cow to the limit of her milk-producing capacity and furnishes a good check on the efficiency of different rations and of different animals. Samples of convenient record blanks may be obtained from the various agricultural colleges or the United States Department of Agriculture.

COMMERCIAL FEEDS

Most States require that each sack or package of commercial or concentrated feed, such as mill feeds and packing-house by-products, bear a tag giving some sort of analysis of the feed. Usually the per cent of crude protein, fat, and fiber is shown, and sometimes all the ingredients are given.

State officials who have charge of feed supervision publish bulletins and reports from time to time giving the State requirements for commercial feeds and the results of analyses of samples of the different feeds for sale within the State.

Livestock feeders should obtain copies of these bulletins and inform themselves concerning the best feeds to buy, and learn how to read and interpret feed tags.

Most farmers have in their farm-grown feeds an excess of fat and carbohydrates and a shortage of protein. Therefore the percentage of protein contained in a commercial concentrate is one good measure of its value. Commercial feeds of inferior quality usually contain a large percentage of crude fiber, which is of but little feeding value and therefore a very costly ingredient in a high-priced feed.

READY-MIXED FEEDS

There are on the market a great many proprietary feeds which are aimed to furnish a ready-mixed, balanced feed for the different classes of animals. Many of these feeds are excellent and represent years of effort by the manufacturers to produce well-balanced and highly palatable feeds at reasonable prices. Others contain quantities of screenings, hulls, or other material of low feeding value. All such feeds should be bought with a guaranty as to the ingredients making up the mixture, or with a guaranty statement of the amounts of crude protein, fat, and fiber contained in them. Hogs, as a rule, should be given the various feeds separately and permitted to make their own choice.

WHEN SHOULD FEEDS BE MIXED AT HOME?

Farmers who are able to produce a variety of the proper feeds cheaply may save money by mixing their own feeds. But whether it pays best to mix feeds at home or buy ready-mixed feeds depends largely on the value of farm grains plus the cost of grinding and mixing, as compared with the price of the commercial feeds plus the freight and hauling. Many city poultry feeders, for instance, find it cheaper and less troublesome to buy ready-mixed scratch grains and mash than to buy the grains and do their own mixing. It is often a good plan to try both home-mixed and ready-mixed feeds and observe the comparative results.

PART II.—DIRECTIONS FOR FEEDING VARIOUS CLASSES OF FARM ANIMALS**FEEDING HORSES**

In feeding horses the points that follow are a general guide, but the feeder should consider also their age, size, condition, and temperament. Two horses of about the same size and type often vary greatly in their feed requirements when doing the same work. A nervous disposition commonly accompanies the use of a large quantity of feed. If the work horse is underfed it will lose body weight and energy and become weakened and liable to disease.

To furnish continuous energy for work the horse must receive feed in excess of that needed for body maintenance. The amount of feed needed for maintenance is about two-thirds that needed by a horse at moderate work.

One of the best grains for horses is oats, because of the hull, which furnishes bulk enough to prevent the horse from gorging. To prevent horses from eating oats too rapidly, a little chopped clover hay or some whole corncobs may be placed in the feed box with the oats.

Corn is also a good feed for horses. Wheat bran, because of its mild, laxative effect, is very valuable for mixing with other feeds for idle horses and colts.

Even though not so nutritious as legume hays, timothy is the most popular roughage for horses, because it is usually free from dust.

Pasture is a valuable and appetizing feed for horses, whether idle or working. Alone it is not sufficient for horses at work, but should be supplemented with hay and a grain ration relatively high in protein.



FIG. 2.—Good pasture makes thrifty colts

Change the horse's feed occasionally, though not suddenly. A horse likes variety in its diet.

FEEDING LIGHT HORSES

In horses of the light breeds that are used for driving, riding, or racing, the qualities for which they are fed include action, spirit, and endurance. Large, paunchy stomachs are therefore objectionable. The following points should be observed in feeding light horses:

They require proportionately more grain and less hay than work horses.

Oats easily rank first among the feeds for light horses; crushed or soaked barley and bran are good supplementary feeds.

Corn is too fattening to constitute the bulk of the grain ration for light horses.

A mixture of alfalfa (or clover) hay and timothy furnishes a good roughage.

FEEDING WORK HORSES

The quantity of feed for the work horse depends on the amount of work to be done and on the speed at which it is performed; a horse requires considerably more feed when working at a trot than at a walk. Following are general rules for average horses:

Allow $1\frac{1}{10}$ pounds of grain and $1\frac{1}{2}$ pounds of hay per 100 pounds of weight for a horse at moderate work.

Allow $1\frac{1}{3}$ pounds of grain and $1\frac{1}{4}$ pounds of hay per 100 pounds of weight for a horse at hard work.

As shown in the following rations, the kinds of grain and hay should govern the quantities used.

SUGGESTED DAILY RATIONS FOR HORSES

Rations for 1,000-pound idle horse:

Ration No. 1:	Pounds	Ration No. 2:	Pounds
Ear corn-----	5	Cowpea hay-----	5
Alfalfa or clover hay---	3	Corn silage-----	5
Corn stover-----	9	Timothy hay-----	10

Rations for 1,000-pound horse at very light work:

Ration No. 3:	Pounds	Ration No. 4:	Pounds
Oats-----	8	Cowpeas (cracked)---	5
Alfalfa or clover hay---	4	Molasses-----	5
Timothy hay-----	6	Oat straw-----	10

Rations for 1,000-pound horse at medium work:

Ration No. 5:	Pounds	Ration No. 6:	Pounds
Ear corn-----	13	Shelled corn-----	11
Alfalfa or clover hay---	6	Cowpea hay-----	6
Timothy hay-----	7	Corn stover-----	6

Rations for 1,000-pound horse at hard work:

Ration No. 7:	Pounds	Ration No. 8:	Pounds
Oats-----	12	Rolled barley-----	10
Bran-----	2	Gluten meal-----	2
Timothy hay-----	8	Alfalfa or clover hay---	8
Clover or alfalfa hay---	5	Prairie hay-----	6

FEEDING SILAGE TO HORSES

Good silage may be fed to horses in limited quantities as a supplement to the regular ration. Good silage acts as an

appetizer and a tonic, but it should not be fed in larger amounts than 10 pounds daily per animal. To feed moldy or frozen silage to horses is a dangerous practice.

WATERING HORSES

Horses require about 10 or 12 gallons of water daily. If the horse has not had water for several hours and has been at hard work, it should be watered before being fed. To allow a horse to drink too freely while warm is dangerous, but a small drink taken slowly will do no harm.

SALT FOR HORSES

Salt should be kept before horses at all times. Their great relish for salt shows their need for it. It is best to give salt separately from the feed.

CARE OF HORSES' TEETH

Even the most careful feeding may leave the horse in poor condition if its teeth are not sound and even so as to permit proper chewing of the feed. Sometimes the first or milk teeth of young horses remain longer than they should, causing the permanent teeth to grow crooked. This should be watched for and the milk teeth removed with forceps.

FEEDING THE BROOD MARE

If possible, brood mares should be kept working up to within about a week of foaling, but heavy work should be avoided as foaling time approaches. The following rules should be followed:

No dusty, moldy, or decayed feed should be given.

Feeds containing plenty of protein, lime, and phosphorus should be supplied.

Bran, linseed meal, or other laxative feeds should be added to the ration to keep the mare's digestive tract active.

A few days before foaling, the grain allowance should be decreased, and plenty of laxative feeds given.

A small feed of bran is good for the first meal after foaling, and the ration for several days should be light.

Within a week the mare may be turned on pasture, and at the end of two weeks put at light work.

FEEDING THE COLT

The mare should be given plenty of pasture grass and grain to stimulate a plentiful supply of milk for the foal.

When from three to four weeks old the colt should be given some grain. A good mixture is 4 parts crushed corn, 3 parts bran, and 1 part linseed meal.

As soon as it will eat hay, provide some good legume hay.

Plenty of good, fresh water should be given both the mare and foal.

Colts once stunted never fully recover. Always keep in mind that colts get more than half their full growth during the first year.

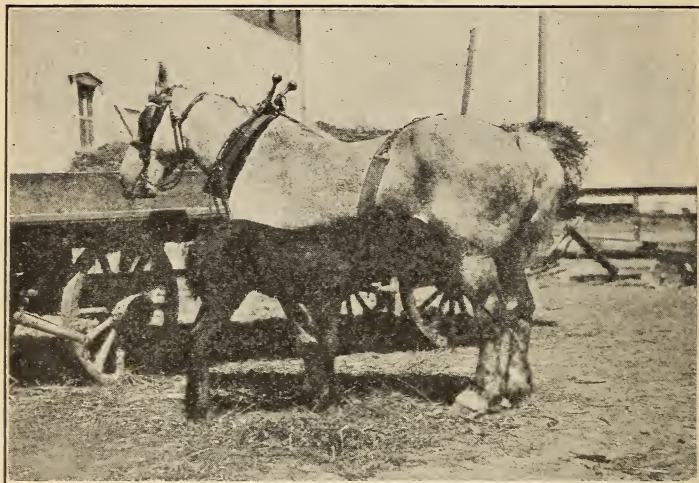


FIG. 3.—While the colt is young it should nurse at frequent intervals. The mare should be allowed to cool off if warm from hard work

FEEDING THE ORPHAN COLT

If the mare dies the foal may be raised on cow's milk if care is taken. The following points should be kept in mind:

Milk from a fresh cow whose milk is low in fat content is the best.

One tablespoonful of sugar and from 3 to 5 tablespoonfuls of limewater should be added to each pint of milk.

The milk should be fed when warmed to blood heat. One-fourth of a pint should be given every hour for the first few days.

After that six, and later four, feedings a day will be sufficient and the quantity of milk may be gradually increased.

Begin feeding grain and hay as soon as possible.

WEANING THE COLT

The colt should be weaned at from 5 to 6 months old, when it is eating plenty of grain and hay. Separate completely from the mare. Having several foals together in the same lot keeps them more contented.

FEEDING THE STALLION

Depending on the extent of service, the stallion should receive varying quantities of protein in the feed. Plenty of exer-

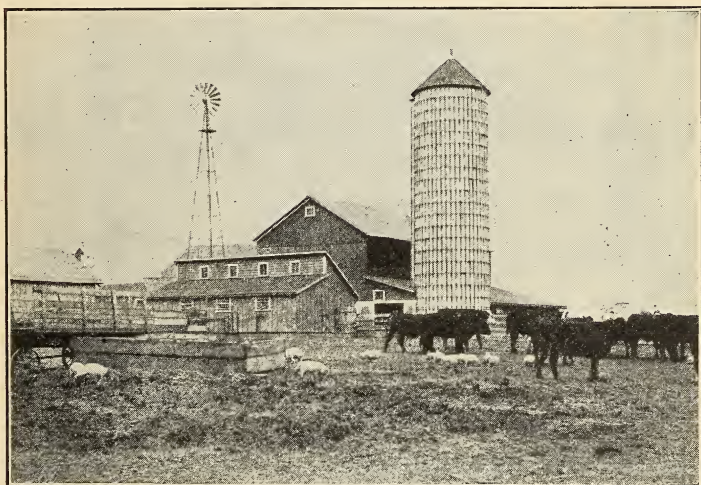


FIG. 4.—Substantial and convenient buildings save feed and labor

cise is desirable. The best exercise for him is moderate work on the farm or on the road.

FEEDING MULES

Mules should be given about the same quantities and kinds of feed as horses. There is no conclusive evidence to support the popular assertion that mules require less feed than horses for the same amount of work. Mules often eat many feeds the horse will not touch, and they are less liable to overeat and founder. Some successful owners allow their mules to run at

leisure to a feed bunk filled with corn. When shedding their milk teeth, at 3 years of age, mules should be fed carefully.

FEEDING BEEF CATTLE

Pasture and roughages should be the foundation of beef-cattle feeding. Pasture is usually the cheapest feed.

Corn is the most widely used fattening feed for cattle. Corn contains too little protein, however, to be fed most economically without legume hay or some concentrate rich in protein, such as cottonseed meal or linseed meal.

Silage is an excellent feed for most classes of beef cattle. Very little roughage is wasted when it is fed as silage.

In most sections the larger the proportion of silage in the ration of a fattening steer the more economical the gains.

The difference between the purchase price and the selling price of the animal is called the "margin" or "spread," and it is usually estimated on the basis of 100 pounds live weight. The principal factors affecting success in feeding cattle are:

1. The purchase price of the cattle.
2. The ability of the cattle feeder himself.
3. Their weight when purchased.
4. The cost of the gain.
5. The length of the feeding period.
6. The selling price.

While all six points are important, the feeder should give special attention to the third and fourth. He usually has more direct control over these than over the other factors.

FEEDING BEEF BREEDING ANIMALS

The breeding herd should be kept on pasture as long as the pasture will maintain the cattle without becoming grazed too closely.

Where the pasture is not sufficient, it should be supplemented with soiling crops, silage, hay, or protein concentrates.

The cows should not be allowed to go undernourished in the fall or winter.

Silage and legume hay make a good combination for winter feeding.

If legume hay is not available, some protein-rich concentrate, such as cottonseed meal or linseed meal, should be given.

FEEDING BEEF BULLS

Herd bulls should enter the breeding season in good, vigorous condition. They may be fed satisfactorily from 1 to 1½ pounds of a grain mixture of equal parts by measure of corn,

bran, and oats, and from 1 to 1¼ pounds legume hay per 100 pounds live weight per day prior to and during the breeding season.

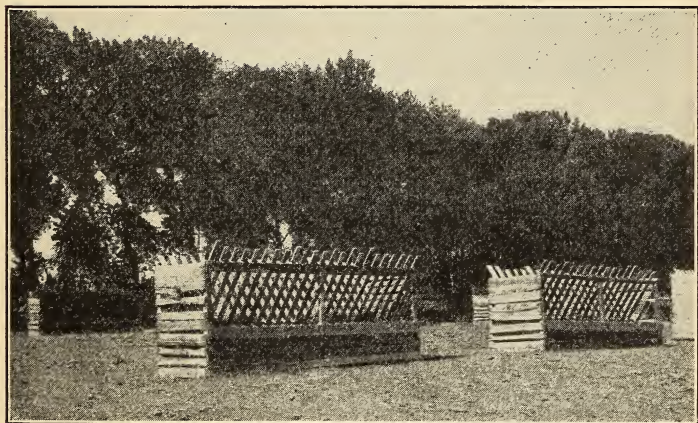


FIG. 5.—A wrong and a right way to feed hay

FEEDING THE BEEF CALVES

Ordinarily, young calves on good pasture with good milking dams do not require any additional feed, but if they are to be developed into breeding animals they should be fed grain in a creep.

A good grain mixture is 3 parts each by weight of corn, oats, and bran, and 1 part of linseed meal.

For the first two or three weeks the corn and oats should be ground.

Keep the troughs clean and do not feed stale or moldy feed.

Be sure that calves have learned to eat some feeds that keep them growing before attempting to wean them.

When weaning, take them away from the cows abruptly, if possible, keeping them where they can neither see nor hear the cows.

FEEDING YOUNG BEEF BREEDING STOCK

Heifers and young bulls intended for breeding should be kept growing winter and summer in order to reach their full development. If stunted while young the expense of development will be increased.

FEEDING CATTLE FOR BEEF

Calves to be marketed as baby beefs should be from well-bred stock that is blocky and of excellent beef type and conformation.

The calves must be kept growing constantly and rapidly.

If their dams are not supplying milk enough they should be fed grain even when on good pasture.

Before weaning they should be eating grain readily, so that they will keep right on growing and fattening without interruption.

It requires feed with a larger percentage of concentrates and richer in protein to fatten calves than to fatten older cattle.

Spring calves weaned in the fall and kept in the feed lot should be ready to sell the following spring before flies and hot weather come. Do not try to use pasture for them in the spring.

Fall-born calves may be weaned in the spring after the grass is good. They should have been taught to eat grain during the winter and should continue on a full feed of grain while on pasture. Early in the fall they should be sold off of grass or put into a lot and fattened more. Silage is then best to take the place of grass.

If they have been properly fed and cared for, baby beefs should be ready for market at from 12 to 18 months of age.

Stockers are calves not sold as veal nor fattened as baby beef, but kept through from one to three winters before being fat-

tened. Cheap summer pasture is essential to success in this line of feeding. Stockers make good use of cheap roughages also.

Stocker should be kept growing at the rate of from 250 to 300 pounds per year. They should gain fully 10 per cent in winter and more in summer. Stockers which gain in winter make the cheapest gains for the entire year.

Calves and yearlings should gain from 50 to 75 pounds a head during the winter, while 2- and 3-year olds should be fed so as not to lose weight.

FEEDING STEERS IN DRY LOT

Mature steers fatten in from 3 to 4 months, 2-year-olds in 5 to 7 months, yearlings in 8 to 10 months, and calves in 10 to 12 months.

Steers should be begun on feed gradually, giving practically all roughage at first and gradually increasing the concentrates to the full ration to be fed. Take from 30 to 45 days to get them on full feed.

Keep them a bit hungry. Do not overfeed them.

A steer's capacity for feed decreases as the animal becomes fat. The proportion of concentrates should be increased and roughages reduced toward the end of the feeding period.

All laxative feeds should be reduced during the last two or three days before shipping. Some dry roughage, such as timothy or other grass hay, should be fed.

SAMPLE RATIONS FOR FATTENING STEERS

The best ration in most cases is the one that makes the greatest gains at the least cost. Generally speaking, the crops grown on the farm, or locally, form the most economical constituents of a ration. The proportion of concentrate to roughage in the ration, the source of the necessary protein to balance the corn or other fattening feed in the ration, and other problems depend on the locality and the relative prices of the different feeds. The following rations are suggested for fattening 2-year-old steers. They are based on 1,000 pounds live weight.

Ration No. 1:	Pounds	Ration No. 3:	Pounds
Corn -----	20	Cottonseed meal -----	4
Legume hay -----	8	Corn silage -----	40
Ration No. 2:		Straw or stover -----	5
Corn -----	20	Ration No. 4:	
Cottonseed meal -----	2	Corn -----	14
Mixed hay -----	5	Linseed meal -----	2
		Mixed hay -----	5
		Corn silage -----	25

FEEDING STEERS ON PASTURE

Pasture gains are usually the cheapest.

It often pays to supplement the pasture with grain or some meal rich in protein. Even full feeding of corn may be practiced to advantage on pasture in summer.

In regions of heavy fall rains cattle should be marketed before such rains bring on a new growth of grass which is watery and may cause the steers to lose in weight. Likewise in regions where pastures or ranges become dry, the steers should be marketed before they begin to lose.

SHELTER FOR BEEF ANIMALS

Experiments show that during winters of ordinary severity fattening beef animals do as well in open sheds with adjacent yards as in warm barns. Cattle are often fed with good results in open yards with no protection other than windbreaks.

WATER FOR BEEF ANIMALS

Fattening cattle should be supplied with pure water at the rate of not less than 10 gallons per head per day for 2-year-old steers.

SALT FOR BEEF ANIMALS

Beef animals require from one-third to 1 ounce of salt per head daily, depending on their feed. It is usually best to keep salt before them at all times.

HOGS FOLLOWING STEERS

When fattening cattle are being fed corn, corn silage, and other feeds with whole grains, hogs should follow them to consume the undigested grain. At least one hog (100 pounds weight) should be allowed for each 1,000-pound steer.

FEEDING DAIRY CATTLE

The dairy cow usually reaches her highest production late in the spring or early in the summer, when she is on good pasture. She is then both comfortable and well fed. Feeders should imitate these ideal conditions as closely as possible throughout the year.

Pasture is the natural feed for dairy cows. Good pasture is succulent and palatable and rich in protein, minerals, and vitamins.

If, from lack of proper feed, water, or care, the dairy cow falls off in her flow of milk, it is difficult or impossible to bring her back to a full flow until she freshens again.

Succulent feeds are of even more importance in feeding dairy cows than in feeding other farm animals. They are highly palatable and have a beneficial, laxative action.

Succulent feeds must be used to supplement short or parched pastures in summer, and to take the place of pasture in winter, or the cows will fall off in production of milk.

Heavy-producing cows should receive grain even when the pasture is the best. They can not eat and digest pasture grass enough to reach maximum production.

Pasture should not be used too early in the spring. This harms the pasture for the rest of the season, and the watery grass causes the cows to fall off in production.

A cow giving a full flow of milk needs fully as much feed as a horse at hard work. She can not get sufficient nourishment to maintain her own body and produce milk at the same time from roughage alone.

COMPOUNDING A GRAIN MIXTURE FOR DAIRY COWS

A degree of bulkiness in the grain mixture aids digestion. When heavy feeds (like corn meal) are used, some bulky ones (like bran) should be included to lighten the mixture.

The mixture should be palatable, eagerly eaten by the cow, and neither too constipating nor too laxative. Cottonseed meal is constipating and should not form more than one-third of the mixture. Linseed meal is laxative and should not be fed in greater quantities than $1\frac{1}{2}$ pounds a day.

Make up the kind of mixture to fit the roughage available. With roughage entirely of the low-protein class the grain should contain from about 18 to 22 per cent protein, while with exclusively high-protein roughage the grain ration need contain only 13 to 16 per cent. (See tables classifying various grains and roughage, pp. 46 and 47.)

Select grains that will furnish the various constituents, especially protein, at the least cost, using home-grown grains if possible.

GRAIN MIXTURES FOR DAIRY COWS IN SUMMER

In supplementing pasture with grain it is not necessary for the percentage of protein in the grain mixture to be so high as for winter feeding, because good pasture is an approximately balanced ration. The grain ration to be fed with grass should, therefore, have about the same proportion of protein to other nutrients as the grass has.

Mixtures good for supplementing pasture without other roughage

Mixture No. 1:	Pounds	Mixture No. 2:	Pounds
Ground oats-----	100	Wheat bran-----	100
Wheat bran-----	100	Corn meal-----	100
Corn meal-----	50	Cottonseed meal-----	25

GRAIN MIXTURES FOR DAIRY COWS IN WINTER

The following mixtures should be taken as suggestions rather than as rations to be followed exactly. Using these mixtures as guides, the feeder of dairy cattle should work out a mixture that will be most economical under his conditions.

Mixtures to be fed with low-protein roughages, such as corn silage, corn stover, timothy, prairie or millet hay, cottonseed hulls, etc.:

Mixture No. 3:	Pounds	Mixture No. 4:	Pounds
Corn meal-----	100	Corn meal-----	200
Cottonseed meal-----	100	Cottonseed meal-----	150
Linseed meal (old process)-----	100	Gluten feed-----	100
Wheat bran-----	200	Wheat bran-----	100

Mixtures to be fed with high-protein roughages, such as legume hays:

Mixture No. 5:	Pounds	Mixture No. 6:	Pounds
Corn meal-----	400	Barley-----	300
Cottonseed meal-----	100	Cottonseed meal-----	100
Gluten feed-----	100	Alfalfa meal-----	100
Wheat bran-----	100	Wheat bran-----	100

Mixtures to be fed with combinations of low and high-protein roughages:

Mixture No. 7:	Pounds	Mixture No. 8:	Pounds
Corn-and-cob meal-----	200	Corn meal-----	100
Cottonseed meal-----	100	Cottonseed meal-----	100
		Ground oats-----	100
		Wheat bran-----	100

HOW MUCH ROUGHAGE TO FEED DAIRY COWS

Dairy cows should be given all the roughage that they will clean up, many feeders feeding as much as 3 pounds of silage and 1 pound of dry roughage for every 100 pounds live weight.

FEEDING DAIRY COWS ACCORDING TO PRODUCTION

The quantity of grain mixture, grain, or other concentrate that should be given the dairy cow depends on three things, as follows:

- The quality and quantity of the roughages fed.
- The capacity of the cow for producing milk.
- The relative prices of roughages and concentrates.

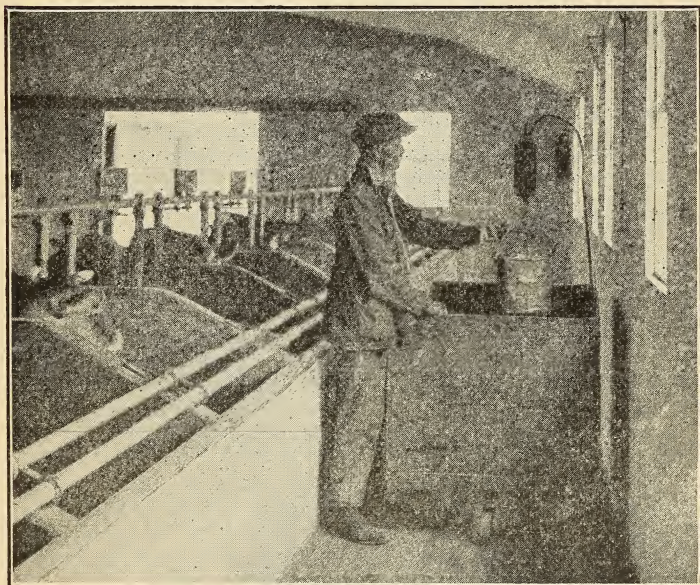


FIG. 6.—Feeding dairy cows according to production. Note the scales attached to feed truck for convenience in weighing feed

All cows should not be fed alike, because they have different capacities for converting feed into milk. By increasing the feed of the highest-producing cows and carefully consulting the milk sheets on which each cow's daily production is recorded, the skillful feeder will soon find that some cows in the herd respond to the increased allowance and return a profit on the additional feed given. On the other hand, there are cows that have a limited capacity for milk production and are very liable to be overfed. When corn and other concentrates are cheap as

compared with hay and other roughages, they should be fed in larger quantities than when unusually high in price.

The following rules furnish a good guide for feeding grain or other concentrates (usually in the form of a grain mixture) to dairy cows, under most circumstances:

Feed a grain mixture in the proportion of 1 pound to each 3 to 4 pints or pounds of milk produced daily by the cow; or 1 pound of grain mixture for every pound of butterfat that the cow produces during the week.

Feed all the cow will respond to in milk production. When she begins to put on flesh above normal weight, cut down the grain.

WATER FOR DAIRY COWS

One hundred pounds of average milk contain about 87 pounds of water. The dairy cow's water supply, therefore, demands the dairyman's most careful attention. Cows giving milk drink about four times as much water as dry cows. High-producing cows sometimes drink from 200 to 300 pounds of water a day. The production of many good dairy cows is lessened because they do not get plenty of fresh, pure water. During winter dairy cows should be watered two or three times daily, unless water is kept before them at all times. The water should be at least 15 or 20 degrees above freezing and should be supplied at the same temperature each day. A cow will not drink stale or impure water enough for maximum milk production.

SALT AND OTHER MINERALS FOR DAIRY COWS

A dairy cow requires an ounce or more of salt a day and should have all she needs, but she should not be forced to take more than she wants. It is best, therefore, to give only a small quantity in the feed and to place rock salt in boxes in the yard or pasture where she can lick it at will.

Recent experiments seem to show that the demand for calcium and phosphorus by dairy cows in full flow of milk is so large that these minerals should be supplied in addition to the regular ration when the ration does not contain an abundance of green forage in summer and plenty of well-cured legume hay in winter.

Both calcium and phosphorus will be supplied in sufficient quantity by adding from 2 to 4 pounds of steamed bone meal or ground rock phosphate to each 100 pounds of grain mixture.

FEEDING DAIRY COWS BEFORE CALVING

Many cows fed a liberal ration for from four to six weeks before calving will easily pay for the additional feed through

the increased flow of milk in the subsequent lactation period. Dairymen usually find it most profitable to give the cow a rest by drying her off for that length of time, even though she continues to give milk up to the time of calving.

FEEDING THE DAIRY BULL

The dairy bull in full service should receive about the same ration as the cow in milk. His ration should contain an ample amount of protein. When idle or in partial service less concentrate will be needed.

FEEDING YOUNG DAIRY STOCK

The following rules furnish a good guide for the feeding of dairy calves and young dairy stock:

The calf's first few meals should be the colostrum—its mother's first milk—to start and regulate the movement of the bowels.

Everything about the calf should be scrupulously clean.

Calves should be fed sweet milk of a uniform temperature (about 90° F.), and they should always receive a little less than they desire.

Milk from infected cows or from a creamery should be pasteurized before it is fed.

All calves should be fed regularly, with equal intervals between feeds; very young calves should be fed three times a day.

First and second weeks.—For the first four days whole milk from the dam should be fed. A 50-pound calf should receive about 8 pounds of milk a day; a 100-pound calf, 12 pounds a day.

After this time whole milk from any cow in the herd (preferably milk containing not more than 4 per cent butterfat) may be fed.

Third week.—At the beginning of the third week skim milk may be substituted at the rate of 1 pound a day. The total quantity of the daily ration may be increased by from 2 to 4 pounds, but this should be done very gradually.

Fourth week.—During the fourth week the change to skim milk should be continued until by the end of the week only skim milk is fed. With especially vigorous calves the change to separated milk may be made about a week earlier.

Fifth week and thereafter.—The quantity of separated milk can be gradually increased until 18 to 20 pounds a day are given, taking care to cut down the quantity at once if the calf leaves some in the pail.

When the calf is 2 months old sour milk, whether whole, skim, or buttermilk, may be fed without harmful results, provided the change from sweet milk is made gradually.

Feed other than milk.—When from 2 to 3 weeks old the calf will begin eating a little bright hay and grain. When it learns to eat them, as much hay and grain as it will clean up twice daily should be given. A good grain mixture is 3 parts (by weight) cracked corn and 1 part wheat bran.

Pasture, if available, should be provided when the calf is from 3 to 4 months old.

A little silage of choice quality may be given after the calf is 2 months old. When 6 months old, not to exceed 8 to 10 pounds may be fed daily, with some dry roughage and grain.

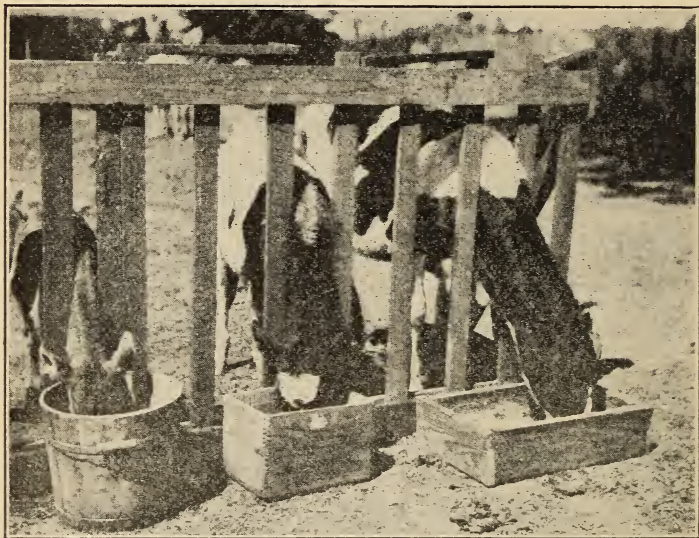


FIG. 7.—Feeding grain to calves in a homemade stanchion

The use of milk is usually discontinued at the age of 5 or 6 months.

Milk substitutes lack much of being as satisfactory as either whole or skim milk. Recipes for calf meals are given in Farmers' Bulletin 1336, Feeding and Management of Dairy Calves and Young Dairy Stock.

Scours always hinders the growth and development of the calf. Reduce the feed immediately at least half and look for the cause. It is commonly caused by irregular feeding, over-feeding, sudden change of feed, fermented feeds, feeding dirty

or sour milk or milk from diseased cows, the use of dirty pails or feed boxes, or by damp and dirty quarters—conditions that the feeder should remedy.

FEEDING HOGS

Neither growing nor fattening pigs do well on corn alone. It is lacking in mineral matter and protein, and the proteins are not sufficient to balance the ration.

Corn should be supplemented with feeds like tankage, fish meal, shorts or middlings, old-process linseed meal, soybeans,

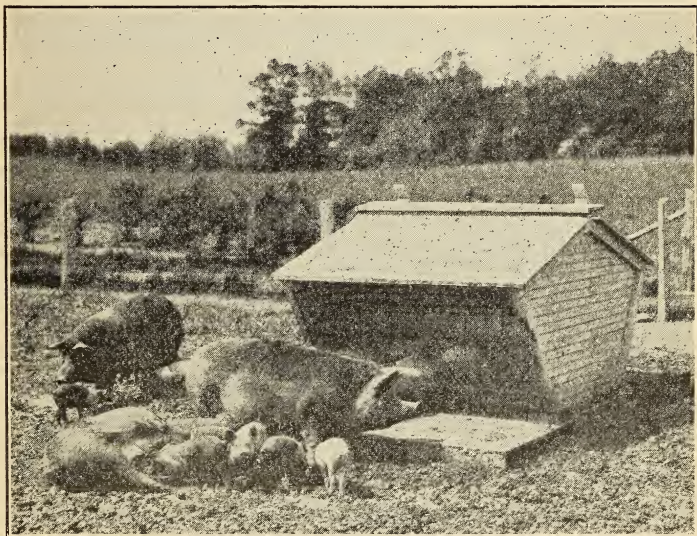


FIG. 8.—An economical self-feeder that can be regulated to reduce waste. It also protects feed from rain

skim milk or buttermilk, or good pasture crops, which supply proper proteins and minerals. Where corn is not available and such feeds as barley, peanuts, and sweet potatoes are fed, care should be taken to provide proper supplementary feeds.

Good pasture for growing pigs, brood sows, and all other classes of hogs is so valuable that it often constitutes the difference between profit and loss in the hog business.

Because they are fed largely on grains, because of their rapid growth, and because they are sometimes fed in dry lot and deprived of pasture, hogs require more minerals than horses,

cattle, or sheep. Lack of sufficient protein and minerals causes sows to produce unthrifty litters.

Self-feeders are excellent for feeding fattening pigs. They save labor and therefore help make cheap gains.

The practice of harvesting corn or other grain crops with hogs (commonly called "hogging down") has been proved to be economical.

Cottonseed meal can not safely be fed to hogs; they may, however, follow steers that have been fed cottonseed meal.

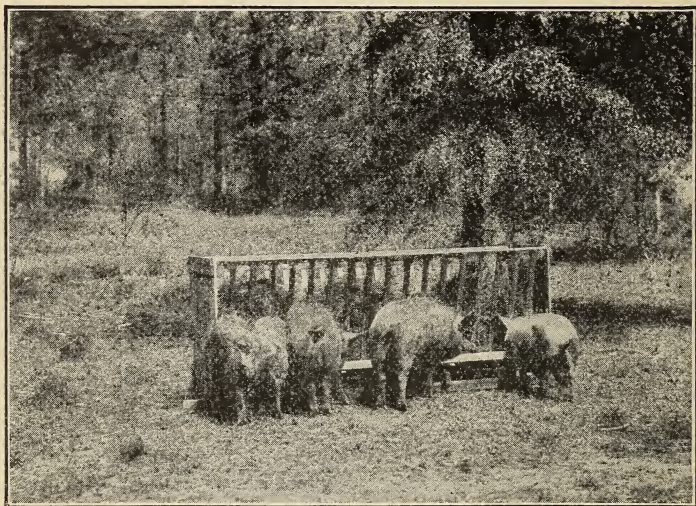


FIG. 9.—Alfalfa hay fed to brood sows adds bulk to the ration and is an excellent protein supplement

FEEDING BROOD SOWS

Feeding during pregnancy should be liberal, but not so heavy as when the pigs are being suckled. An overfed sow produces pigs low in vitality, and she will be clumsy with them. An underfed sow, on the other hand, can not nourish an average litter of pigs properly.

During pregnancy the sow should receive feeds containing plenty of protein, mineral matter, and water. She should have comfortable quarters, be allowed plenty of room for exercise, and be kept free from lice.

Her grain ration should be fed dry, and toward the close of the gestation period it is advisable, if constipation is present, to feed a small quantity of linseed meal.

During the winter root crops are excellent to take the place of pasture and furnish succulence.

For three or four days before farrowing the sow's feed should be reduced somewhat.

The sow should have no feed the first 24 hours after farrowing, but should be liberally supplied with warm water. Then a thin slop of bran and middlings may be given.

For three or four days the feeding should be light, and full feed should not be given for a week or 10 days.

If the pigs scour, the sow is being overfed. If this trouble appears, discontinue feeding the slop to the sow, and give a small quantity of oats, scattered thinly on the floor. Dissolve a piece of rock lime, slightly smaller than a baseball, in a gallon of water, drain the water off the slaked lime and give it to the sow to drink; also bathe the sow's udder and teats with the limewater. In addition give the pigs (on the tongue) 1 drop of formalin solution prepared by mixing 1 ounce of standard strength formalin and 1 pint of water. Also the sow's teats may be washed once or twice daily with a solution of formalin prepared by adding 1 ounce of this mixture to a second pint of water.

FEEDING THE YOUNG PIGS

The first opportunity to assist the sow in feeding the young pigs comes when they are about 3 weeks old, when a creep should be provided in the sow's pen or pasture containing shelled corn in a self-feeder. When the pigs are 5 or 6 weeks old middlings or shorts, tankage, or fish meal should be supplied in a separate compartment of the feeder. Pasture is desirable at all times.

WEANING THE YOUNG PIGS

The young pigs should be weaned when from 10 to 12 weeks old, depending on the condition of the pigs and sow and whether the sow is to raise two litters a year. It is important that the pigs be eating grain before being weaned. Four or five days before weaning reduce the sow's feed at least half.

Weaning should be complete. Do not return the pigs to the sow. Also do not change the ration of the pigs when weaning. If skim milk is available it may be added, but in limited quantities. Any abrupt change in the diet should be avoided.

Good pasture is always desirable for young pigs.

FEEDING BREEDING PIGS

Pigs to be kept for breeding purposes should be fed with the object of making them stretch out and develop bone and muscle in place of fat. After young gilts have been bred they must be fed a ration sufficient to grow the litter and properly finish their own growth.

FEEDING FATTENING PIGS

After weaning, the pigs to be fattened may be fed in two periods: (1) The growing period, from weaning until within

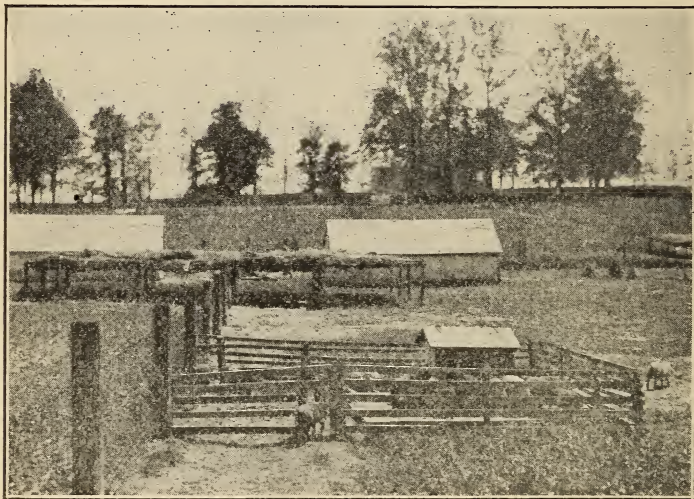


FIG. 10.—Pigs eating from a self-feeder placed inside a creep. Temporary shade (shown in background) is necessary where natural shade is lacking

six weeks to two months of the marketing date; and (2) the finishing period, from that time up to marketing.

The ration during the growing period is much the same as that given breeding stock, except that more grain should be allowed. Plenty of pasture should be available. In feeding grain on pasture more success has been had by giving an amount equal to 3 per cent of the body weight than feeding in smaller quantities.

Much more corn and less protein concentrates are fed during the finishing period. A good ration would contain 10 pounds

of corn to 1 pound of tankage. The change in the ration must be gradual and the increase in feed not too rapid, in order to keep the pig from going off feed.

Pastures furnishing plenty of protein, such as alfalfa and clovers, are excellent at this time to keep the pigs' appetites keen.

Pigs may also be fed successfully from weaning to market weights by supplying corn, protein feeds, and minerals in separate compartments of a self-feeder.

SELF-FEEDERS FOR HOG FEEDING

Self-feeders have been proved to be very valuable for feeding hogs for market. They have the following advantages:

Hogs consume feed more rapidly and therefore make larger daily gains.

They reach a marketable size at an earlier date.

There is an actual saving in the amount of feed required to produce 100 pounds of gain.

The self-feeder saves labor in hog feeding.

Two methods are practiced in using self-feeders for hogs. The grain and protein supplement may be mixed and fed from the same hopper, or they may be fed separately, allowing the pig to choose for itself. The latter method is preferred. Experiments show that the pig usually balances its ration properly, eating relatively less of the high-protein feeds as it gains in weight.

Though sometimes used for sows suckling pigs, self-feeders ordinarily are not used for feeding breeding hogs, because the hogs are liable to become too fat.

FEEDING THE BOAR

The boar should be given plenty of protein feeds during the breeding season; he should be fed some laxative feed, such as wheat bran, and should have the run of a quarter acre or more of pasture in connection with his paddock.

MINERAL MIXTURE FOR HOGS

In order to make sure that the hogs have plenty of mineral matter, a mixture such as the following should be kept before them at all times:

	Pounds		Pounds
Charcoal	75	Pulverized copperas	1
Raw rock phosphate	3	Glauber salt	6
Salt	6		
Ground limestone	6	Total	100
Flowers of sulphur	3		

FEEDING GARBAGE TO HOGS

When properly managed, the feeding of garbage to hogs is a practical means of pork production. The following points should be kept in mind in feeding garbage.

The garbage should be collected frequently and be free from tin cans, soap, broken glass, and other undesirable or injurious articles.

Raw garbage is better than cooked garbage, because pigs fed raw garbage will reject portions distasteful to them, while cooking mixes the product, forming a mass which may contain substances injurious to hogs and less valuable as a feed.

Frozen garbage should be thawed before it is fed.

Hogs to be fed garbage should be immunized against cholera by the double, or simultaneous, treatment. This is very important because of the frequent presence of raw pork scraps which may carry the disease.

WATER FOR HOGS

Hogs drink from 4 to 12 pounds of water daily per 100 pounds live weight. Many hog feeders make the mistake of not providing water enough. When given cold water in cold winter weather hogs are also liable to drink too little; ice on top of the water in the trough is still another cause for the hogs going thirsty.

When the ration contains milk or slop, less water is needed, but it is best to provide it in a clean trough or automatic waterer at all times.

FEEDING SHEEP

Gentle handling, regular feeding, and quiet are especially important in feeding or fattening sheep.

Silage or root crops in proper amounts are useful in keeping ewes in good condition during the winter.

The breeding flock in summer needs good pasture, shade, salt, and plenty of fresh water.

Frequent changes of grazing ground in most sections are necessary to insure freedom from serious stomach-worm infection when pastures do not provide a wide range.

When fattening lambs raised on grass they should be made accustomed to grain and silage gradually, to prevent scouring and other digestive troubles.

The practice of harvesting corn with fattening lambs or sheep is a good one. Some crop, such as soybeans or rape, should be grown in the corn.

At the time ewes are bred they should be gaining in weight. Placing the ewes on abundant pasture or adding a grain sup-

plement for two or three weeks before breeding—a practice called “flushing”—tends to increase the proportion of twin lambs and thus increases the lamb crop. In six years of experimental work the Bureau of Animal Industry found that there was an average of 187 more lambs per 1,000 ewes as a result of flushing.

Timothy hay is not good sheep feed; legume hays are excellent.

Only silage from well-matured corn should be used for sheep, and caution should be exercised to guard against feeding spoiled, frozen, or moldy silage.

FEEDING THE BREEDING EWES

Before the start of the breeding season in the fall all non-breeding, poor-milking, and broken-mouthed ewes should be discarded from the flock.



FIG. 11.—Harvesting crops with livestock saves labor

Have the ewes gaining in weight when they are bred.

Stubble and stalk fields, fence strips in plowed fields, late pastures, green rye pastures late in the fall, and velvet beans (in the South) will help carry the breeding flock through the fall and well into the winter.

Legume hays, straw, and cornstalks usually form the main part of economical winter feeding.

Silage and root crops are good feeds, but should not be used when the pasturage is soft and watery.

Heavy grain feeding just before lambing may cause udder trouble.

After lambing, ewes should be fed lightly at first, and put on full feed about the third or fourth day.

RATIONS FOR BREEDING EWES

Each of the following rations contains approximately the quantity of the various nutrients required daily for ewes of from 120 to 145 pounds in weight:

Ration No. 1:	Pounds	Ration No. 3:	Pounds
Alfalfa or cowpea hay	2	Alfalfa	2½
Corn silage	2	Silage	2
Shelled corn	½	Ration No. 4:	
Ration No. 2:		Oat straw	1
Alfalfa	2	Corn silage	2
Corn stover (amount eaten)	2	Linseed meal	¼
		Shelled corn	½

FEEDING THE LAMBS

Well-nourished lambs from well-fed ewes have few troubles, but following are some points to bear in mind:

Constipation is remedied by a teaspoonful of castor oil.

White scours can be cured by giving one-fourth ounce of cooking soda, 1 ounce of sulphate of magnesia, and a pinch of ginger in a small quantity of flaxseed tea. The flaxseed tea is made by dissolving 1 teaspoonful of ground flaxseed in 1 pint of hot water. This should be followed in about four hours with 2 ounces of raw linseed oil.

If lambs are sold at 3 to 5 months of age, they may run with their dams until that time. Lambs to be kept for breeding should be weaned at from 4 to 5 months of age and put on fresh pasture where there is no danger of stomach worms.

The best method of weaning is to leave the lambs on the old pasture for three or four days and remove the ewes to a scanty pasture to check their milk flow.

When from 10 to 16 days old the lambs should have access to a creep where they may get hay in a rack and grain in a trough so arranged that they can not get their feet into the feed. Pea-green alfalfa of the second or third cutting is one of the most relished feeds. Flaky, sweet bran ranks next.

Until the lambs are 5 or 6 weeks old all their feed should be coarsely ground or crushed.

Cleanliness is an important factor in keeping the lambs growing. Always feed in an empty, clean trough, and, if it is dirty, scrub it out with limewater.

PREVENTION OF STOMACH-WORM INJURY

When grass pastures are to be used for a flock turned out when the lambs are from 5 to 8 weeks old it is desirable to have divisions enough to allow frequent changes without returning the lambs to any ground previously grazed in the same season. Hillside pastures are generally freer from stomach-worm infection than bottom lands because of the tendency for the worm eggs to be carried down by rains. Moreover, the greater moisture in bottom lands favors development of the worms. Hill-sides are consequently safer and better pastures for lambs, though the pasture may be less luxuriant. Lambs that are 6 weeks old when sent to pasture, and that have received some grain, can withstand a considerable degree of infection by parasites.

RAISING LAMBS BY THE DRY-LOT METHOD

Some breeders of purebred sheep practice a dry-lot method of raising lambs, mainly to avoid stomach-worm trouble. The lambs do not leave the sheds or yards until they are weaned, when they are put on clean, fresh pastures. In the meantime they are fed hay and grain, and their dams are returned from the pastures two or three times each day to allow the lambs to nurse.

Some breeders keep both ewes and lambs in dry lots, growing soiling crops near by to be fed to the ewes to keep them milking well.

RAISING LAMBS BY THE FORAGE-CROP METHOD

The practice of grazing the flock on forage crops until the lambs are sold is becoming popular where lands are high in price and where stomach worms cause trouble. Under this plan the ewes and lambs are first grazed on fall-sown wheat or rye. The land is divided to avoid the necessity of keeping the flock longer than from 10 to 14 days on the same ground. By the time the second lot of this crop is grazed down, spring-grown peas and oats can be ready and the fall-wheat land plowed and reseeded to another cereal, or to rape or soybeans, for later use. This plan produces a large amount of feed per acre.

FEEDING RAMS

Beginning a month before the breeding season rams should be given some extra grain. Two parts of oats and one of bran, by bulk, form an excellent mixture. Oats alone are also very good. If the ram is thin the following mixture, by weight, is

excellent: Corn, 5 parts; oats, 10 parts; bran, 3 parts; and linseed meal, 2 parts. Rams should be fed about the same amounts per 100 pounds weight as breeding ewes.

WATER FOR SHEEP

Sheep frequently suffer for water. A sheep needs from 1 to 6 quarts of water daily, depending on the feed received, the weather, and the condition of pasture.



FIG. 12.—Lambs knee-deep in soybeans. The condition of the forage is reflected in the fatness of the lambs

SALT FOR SHEEP

Salt should be kept before sheep at all times. They will overeat it if supplied only at intervals.

FEEDING MILK GOATS

Milk goats should be given about the same kinds of feeds given dairy cows. From six to eight goats can be kept on the amount of feed usually given one dairy cow. A ration that has been used successfully in the herd of the Bureau of Animal Industry at its experiment farm at Beltsville, Md., for does in milk during the winter season is as follows: 2 pounds of alfalfa or clover hay, 1½ pounds of silage or turnips, and from

1 to 2 pounds of grain. The grain ration consisted of a mixture of 100 pounds corn, 100 pounds oats, 50 pounds bran, and 10 pounds linseed meal.

When the does are on pasture they may be given 1 or 1½ pounds of grain per day of the mixture mentioned, with the exception of the linseed meal.

FEEDING ANGORA GOATS

Most of the feed for Angora goats on the range is browse, weeds, and grass. Evergreen brush (not cedar or other coniferous vegetation) is relied upon for winter feed. When supplemental feed is necessary hays, kale, rape, milo maize, feterita, oats, and similar feeds suitable for sheep are used.

FEEDING POULTRY

FEEDING HENS FOR EGG PRODUCTION

Well-balanced, palatable feeds are necessary to get good egg production. With good stock the additional cost of a good ration is repaid many times by the extra eggs obtained. Following are some points to be observed:

Feed simple grain mixtures supplemented with meat scrap, fish scrap, or milk.

Supply green feed of some kind throughout the year.

Feed a scratch mixture of whole or cracked grains twice daily. Feed sparingly so that the hens will eat all they receive.

Feed a mash, either dry or wet, made of ground grains and meat scrap, properly balanced.

Supply more than one kind of grain.

Make the hens exercise for their feed.

Give a light feed of grain in the morning, only supplying what the hens will clean up in half an hour.

Always give a full feed late in the afternoon, especially in cold weather.

SOME EGG-LAYING RATIONS

The following rations have been used with good results at the Government experiment farm at Beltsville, Md., but the poultry feeder should make substitutions to adapt them to local conditions and prices:

Ration No. 1

Mash:	Pounds	Scratch mixture:	Pounds
Corn meal -----	1	Cracked corn -----	2
Meat scrap -----	1	Wheat -----	1
Bran -----	1	Oats -----	1
Middlings -----	1		
Ground oats -----	1		

Ration No. 2

Mash:	Pounds	Scratch mixture:	Pounds
Corn meal or barley meal-----	2	Cracked corn-----	1
Bran-----	1	Wheat-----	1
Middlings-----	1	Oats-----	1
Meat scrap or fish meal-----	1		

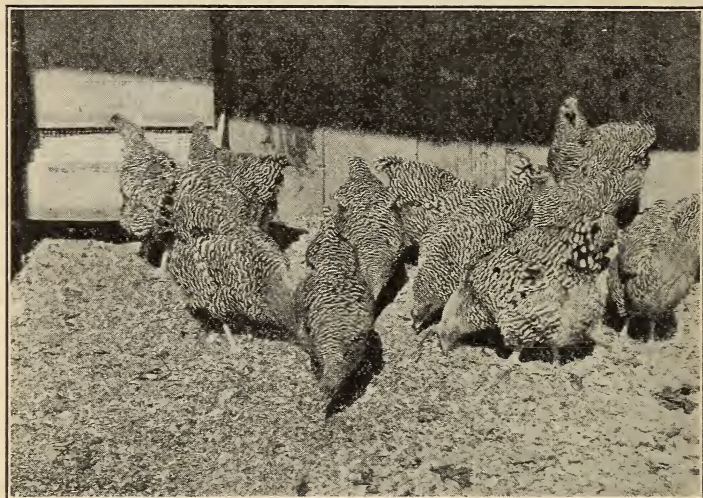


FIG. 13.—Keep the hens busy by throwing scratch feed in deep litter. In the corner is a wall hopper for feeding dry mash

FEEDING THE BREEDING FLOCK

The breeding flock which is maintained to produce fertile eggs that will hatch into vigorous, healthy chicks should be fed differently from the hens kept for market-egg production.

Very little highly stimulating feed, such as meat scrap, should be given. The hens should not be forced.

The hens should be made to exercise for their feed by feeding the scratch mixture in a deep litter.

An abundance of green feed should be supplied.

Breeding stock should be outdoors every good day throughout the year, the yards or run to be kept in green crops as much as possible.

Vigorous males should be kept with the flock all the time, and care taken to see that they get plenty of feed. Following is a good ration for the breeding flock.

Mash:	Pounds	Scratch mixture:	Pounds
Bran.....	1	Cracked corn.....	3
Middlings.....	1	Oats.....	2
Corn meal.....	3	Wheat.....	1
Meat scrap.....	1½		
Ground oats.....	1		
Rolled oats.....	1		
Linseed meal.....	½		

FEEDING SITTING HENS

Feed for sitting hens should consist mostly of whole grains, such as corn and wheat. Green feeds and meat tend to make them desire to stop sitting and begin laying.

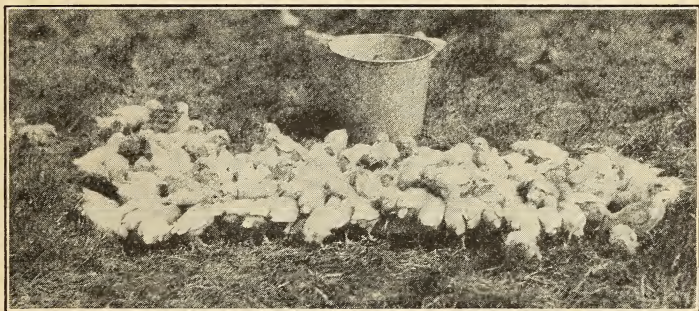


FIG. 14.—Provide feeding boards enough to enable each chick to get its share of feed

FEEDING YOUNG CHICKS

The chicks should not be fed until they are from 36 to 48 hours old. Then the first feed should consist of hard-boiled eggs (for economy use infertile eggs from incubator) mixed with stale bread crumbs or of a mash of equal parts, by weight, of corn meal, bran, and middlings, mixed with milk or with boiled eggs. Use this for the morning feed, followed by commercial chick grain. Rolled oats are fed at noon and chick grain is given again in the afternoon.

A mixture of equal parts of finely cracked wheat, cracked corn, and "pinhead" oatmeal or hulled oats, may be used in place of the commercial chick grain.

A commercial baby-chick scratch feed and chick mash may be used to advantage in place of the home-mixed feeds when only a few chicks are raised.

Milk in some form is very beneficial to small chickens and should be added to the ration if possible.

When the chicks are from 10 days to 2 weeks old feed a growing mash of 4 parts by weight of rolled oats, 2 parts bran, 2 parts corn meal, 1 part middlings, and 1½ parts meat scrap.

When the chickens are 8 or 10 weeks old reduce the rolled oats to 2 parts and the bran to 1½ parts.

The chick feed can be stopped as soon as the chicks will eat whole wheat and cracked corn, feeding equal parts of each.

Green feed must be supplied in some form and chicks will grow best on open grass range. If the birds are confined in small yards, green feed should be supplied.

Fresh, cool water and chick-size grit should always be kept before young chickens.

FEEDING FATTENING CHICKENS

Chickens to be fattened should receive soft feed that can be quickly and easily digested. They should be fed two or three times a day at regular intervals. The following are two good mixtures:

Mixture No. 1:	Pounds	Mixture No. 2:	Pounds
Finely ground corn-----	12	Finely ground oats----	15
Wheat bran-----	4	Finely ground corn-----	15
Wheat middlings-----	4	Low-grade flour-----	2
Meat scrap-----	1	Bran-----	1
		[Mixed with buttermilk.]	

WATER FOR POULTRY

Plenty of fresh water should always be accessible to poultry. It should not be exposed to the sun in the summer nor allowed to freeze in winter. A flock of 50 hens in laying condition requires from 4 to 6 quarts of water a day, supplied preferably in several containers.

GRIT FOR POULTRY

Grit is essential to the health of fowls and also to economy in feeding. A box of grit should be kept in every pen or yard.

LIME FOR LAYING HENS

Laying hens should have crushed oyster shells, clamshells, old mortar, or other sources of lime for the shells of eggs.

SELF-FEEDERS FOR POULTRY FEEDING

Self-feeders save labor in feeding poultry and furnish a good method for feeding dry mash, grit, and oyster shells.

An open, square box about 8 inches deep makes the best mash hopper. It should have a wire screen of 2-inch mesh as a follower laid on top of the mash.

PART III. HANDY INFORMATION AND REFERENCE TABLES

COMMON FEEDS AND THEIR SUBSTITUTES

The following table shows feeds that may be substituted for some of the most common feeds without greatly affecting the ration:

Feed	Feeds that may be substituted, quantities depending on relative feeding value
Whole milk.....	For older animals skim milk supplemented with ground grains. Mature animals may be given buttermilk and whey. The dam's milk, or cow's milk properly modified, is best for very young animals.
Corn.....	Barley, kafir, milo, sorghum, oats, buckwheat, rice, or similar feeds rich in carbohydrates and fats.
Oats.....	Bran, coarse middlings, distillers' dried grains, or feeds having similar physical and nutritive qualities.
Wheat bran.....	Ground oats, other bran, distillers' dried grains, coarse middlings, alfalfa meal, or feeds having similar nutritive and physical qualities.
Linseed meal.....	Peanut meal, gluten feed, copra meal, cottonseed meal (for some animals), velvet-bean meal, or similar feeds high in protein and mineral matter.
Cottonseed meal.....	Cottonseed cake, linseed meal, peanut meal, gluten feed, copra meal, velvet-bean meal, sorghum meal, or similar feeds high in protein and mineral matter.
Tankage.....	Fish meal, shrimp bran, meat scrap, or similar feeds high in protein and mineral matter.
Corn silage.....	Sorghum silage, other silage, pasture, wet beet pulp, roots, and green-forage crops, or similar succulent feeds.
Pasture.....	Silage, wet beet pulp, roots, or forage crops are good supplements. (There is no practical substitute for pasture in most sections if economy is considered.)
Clover hay.....	Other legume hays, such as alfalfa, lespedeza, peanut, soybean, cowpea, or velvet-bean hay.
Timothy hay.....	Other grass hays, mixed hays, oats straw, or similar roughages.
Corn stover.....	Other stovers, grass hays, oats straw, or similar roughages.
Oat straw.....	Corn stover, other stovers, barley straw and other straws, cottonseed hulls, and similar feeds.

WEIGHTS AND MEASURES OF COMMON FEEDS

In calculating rations it is usually necessary to use weights rather than measures. However, it is often handier for the farmer to measure his concentrates. The following table makes this possible:

Weight, in pounds per quart (dry measure) and per bushel

Feed	Weight of 1 quart (approximate to $\frac{1}{4}$ pound)	Approximate weight of 1 bushel
	Pounds	Pounds
Alfalfa feed.....	$\frac{3}{4}$	25
Barley.....	$1\frac{1}{2}$	48
Beet pulp (dried).....	$\frac{1}{2}$	19
Brewers' grains (dried).....	$\frac{1}{2}$	19
Buckwheat.....	$1\frac{1}{2}$	50
Buckwheat bran.....	1	29
Charcoal.....	$\frac{1}{2}$	20
Corn, husked, ear.....		70
Corn, cracked.....	$1\frac{1}{2}$	50
Corn, shelled.....	$1\frac{3}{4}$	56
Corn meal.....	$1\frac{1}{2}$	50
Corn-and-cob meal.....	$1\frac{1}{2}$	45
Cottonseed meal.....	$1\frac{1}{2}$	48
Cowpeas.....	2	60
Distillers' grains (dried).....	$\frac{1}{2}$	19
Fish meal.....	1	35
Gluten feed.....	$1\frac{1}{4}$	42
Linseed meal (old process).....	1	29
Linseed meal (new process).....	1	35
Meat scrap.....	$1\frac{1}{4}$	42
Molasses feed.....	$\frac{3}{4}$	26
Oats.....	1	32
Oats, ground.....	$\frac{3}{4}$	22
Oat middlings.....	$1\frac{1}{2}$	48
Peanut meal.....	1	29
Rice bran.....	$\frac{3}{4}$	26
Rye.....	$1\frac{3}{4}$	56
Soybeans.....	$1\frac{3}{4}$	60
Tankage.....	$1\frac{1}{2}$	42
Velvet beans, shelled.....	$1\frac{3}{4}$	60
Wheat.....	2	60
Wheat bran.....	$\frac{1}{2}$	19
Wheat middlings, standard.....	$\frac{3}{4}$	26
Wheat screenings.....	1	32

SOME FEEDING TERMS EXPLAINED

Concentrates.—Feeds, such as grains, cottonseed meal, and tankage, which are rich and concentrated and supply a large amount of feed per unit weight.

Roughages.—Feeds, such as hay, straws, roots, and silage, which are coarse and bulky in nature.

Legumes.—Plants, such as clover, alfalfa, cowpeas, soybeans, etc., which have on their roots nodules containing bacteria, which can take nitrogen from the air. Legumes are generally richer in protein and minerals than other roughages.

Nutrients.—Substances in feeds which nourish animals.

Protein.—The only nutrient which can produce growth and make repairs in the animal's body. Lean meat, skim milk, wheat bran, cottonseed meal, and tankage are some of the feeds which contain relatively large amounts of protein.

Carbohydrates and fat.—Nutrients which produce fat, heat, and power to do work in the animal's body. Fat is about two and one-fourth times as valuable for these uses as carbohydrates. Feeds containing large amounts of starch and sugar are rich in carbohydrates, while large amounts of fat are contained in oily feeds. Corn is rich in both carbohydrates and fat.

Mineral matter.—Nutrients used principally to build the skeleton, hair, hoof, horn, etc. Legume hays, bran, linseed meal, and skim milk have relatively large amounts of mineral matter.

Vitamins.—Substances found in feeds in very small quantities, which are necessary for growth, reproduction, and protection against diseases, such as scurvy.

Crude fiber.—The coarse, woody part of plants, and one of the carbohydrates much less digestible than the others.

Ration.—The quantity of feed given an animal during one day.

Balanced ration.—A ration which contains the proper proportion of nutrients to nourish properly the animal to which it is fed.

Nutritive ratio, carbohydrate equivalent, and certain other terms are too technical for adequate discussion in this brief handbook. The reader is referred to feeding textbooks and other authorities.

PROTEIN IN LIVESTOCK FEEDS

Since most American farm-grown feeds contain an excess of fat and carbohydrates and a scarcity of protein, the percentage of protein in feeds that have to be purchased is one of the best measures of the value of such feeds. The following tables classify some of the most common roughages and concentrates according to their approximate protein content and will be a good guide in buying feeds. These tables will also be of help in planning rations where it is necessary to know the approxi-

mate amount of protein contained in the various components of the ration.

Digestible protein content of common roughages

LOW-PROTEIN ROUGHAGES

- About 1 per cent:
Rye straw.
Wheat straw.
Oat straw.
- About 3 per cent:
Corn fodder.
Corn stover.
Canada bluegrass hay.
Clover straw.
Cowpea straw.
Soybean straw.
Meadow-fescue hay.
Rye hay.
Timothy hay.
- About 5 per cent:
Buckwheat straw.
Clover and timothy hay.
Barley hay.
Kafir fodder.
Kentucky bluegrass hay.
Millet hay.
Mixed-grass hay.
Oat hay.
Orchard-grass hay.
Prairie hay.
Redtop hay.
Sweet-corn fodder.
Wheat hay.

HIGH-PROTEIN ROUGHAGES

- About 7 per cent:
Alsike-clover hay.
Emmer hay.
Native western bluegrass hay.
Peanut vine (without nuts).
Red-clover hay.
Vetch and oats hay.
- About 9 per cent:
Alfalfa hay (first cutting).
Crimson-clover hay.
Lespedeza hay.
Peas and oats hay.
- About 11 per cent:
Alfalfa hay (second cutting).
Alfalfa meal.
Red-clover hay (before bloom).
Sweet-clover hay.
Soybean hay.
Vetch hay (common vetch).
- About 13 per cent:
Cowpea hay.
Canadian field-pea hay.
Velvet-bean hay.
- About 15 per cent:
Alfalfa hay (before bloom).
Alfalfa leaves.
Hairy-vetch hay.

Digestible protein content of common concentrates

<p>About 5 per cent:</p> <ul style="list-style-type: none"> Beet pulp (dry). Buttermilk. Corn-on-cob meal. Corn meal. Hominy feed. Skim milk. <p>About 10 per cent:</p> <ul style="list-style-type: none"> Alfalfa meal. Barley. Kafir grain. Molasses feeds. Oats. Rice polish. Rye. Sorghums, ground. <p>About 15 per cent:</p> <ul style="list-style-type: none"> Oatmeal. Red-dog flour. Sunflower seed (with hulls). Velvet-bean meal (pods included). Wheat bran. Wheat middlings. <p>About 20 per cent:</p> <ul style="list-style-type: none"> Brewers' grains (dry). Coconut meal. Cowpeas. Distillers' grains (dried). Gluten feed. Fresh-ground bone. Peanut meal (with hulls). 	<p>About 25 per cent:</p> <ul style="list-style-type: none"> Buckwheat middlings. Gluten meal (low grade). <p>About 30 per cent:</p> <ul style="list-style-type: none"> Linseed meal. Soybeans. <p>About 35 per cent:</p> <ul style="list-style-type: none"> Gluten meal (high grade). Cottonseed meal. Meat-and-bone meal. <p>About 40 per cent:</p> <ul style="list-style-type: none"> Peanut meal (without hulls). Soybean-cake meal (fat extracted). <p>About 45 per cent:</p> <ul style="list-style-type: none"> Peanut cake (from hulled nuts). <p>Above 45 per cent:</p> <ul style="list-style-type: none"> Tankage contains from 40 to 60 per cent protein, depending on the method of manufacture. The guaranty tag states the protein content of tankage. Fish meal has about the same protein content as tankage. Dried blood may contain as much as 80 per cent protein.
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SIZE AND CAPACITY OF SILOS

The diameter of the silo should depend on the amount of silage to be fed daily, while the height should be governed by the length of the feeding season. Hence, before constructing a silo the farmer should know approximately (1) the number of animals he intends to feed, (2) the amount of silage to be fed daily, and (3) the number of days silage is to be fed.

In general, the height of the silo should not be less than twice nor more than three times the diameter. The diameter should be small enough to remove silage enough from the

entire surface each day to prevent spoiling. When feeding in winter it is safe to remove as little as 2 inches daily; but for summer feeding 3 inches should be removed daily. The tables below show the capacities of silos of different sizes and the proper diameter of the silo for herds of different sizes for winter and summer feeding:

*Number of animals that can be fed from silos of various sizes
(on basis of 40 pounds of silage per cubic foot)*

Inside diameter of silo	Number of animals that may be fed, allowing—			
	40 pounds per head	30 pounds per head	20 pounds per head	15 pounds per head
WINTER FEEDING TO A DEPTH OF 2 INCHES DAILY				
<i>Feet</i>				
10	13	17	26	35
11	16	21	31	42
12	19	25	37	50
13	22	29	44	59
14	25	34	51	68
15	29	39	59	78
16	33	44	67	89
17	38	50	75	101
18	42	56	85	113
20	52	70	104	139
SUMMER FEEDING TO A DEPTH OF 3 INCHES DAILY				
10	19	26	39	52
11	23	31	47	63
12	28	37	56	75
13	33	44	66	88
14	38	51	77	102
15	44	59	88	118
16	50	67	100	134

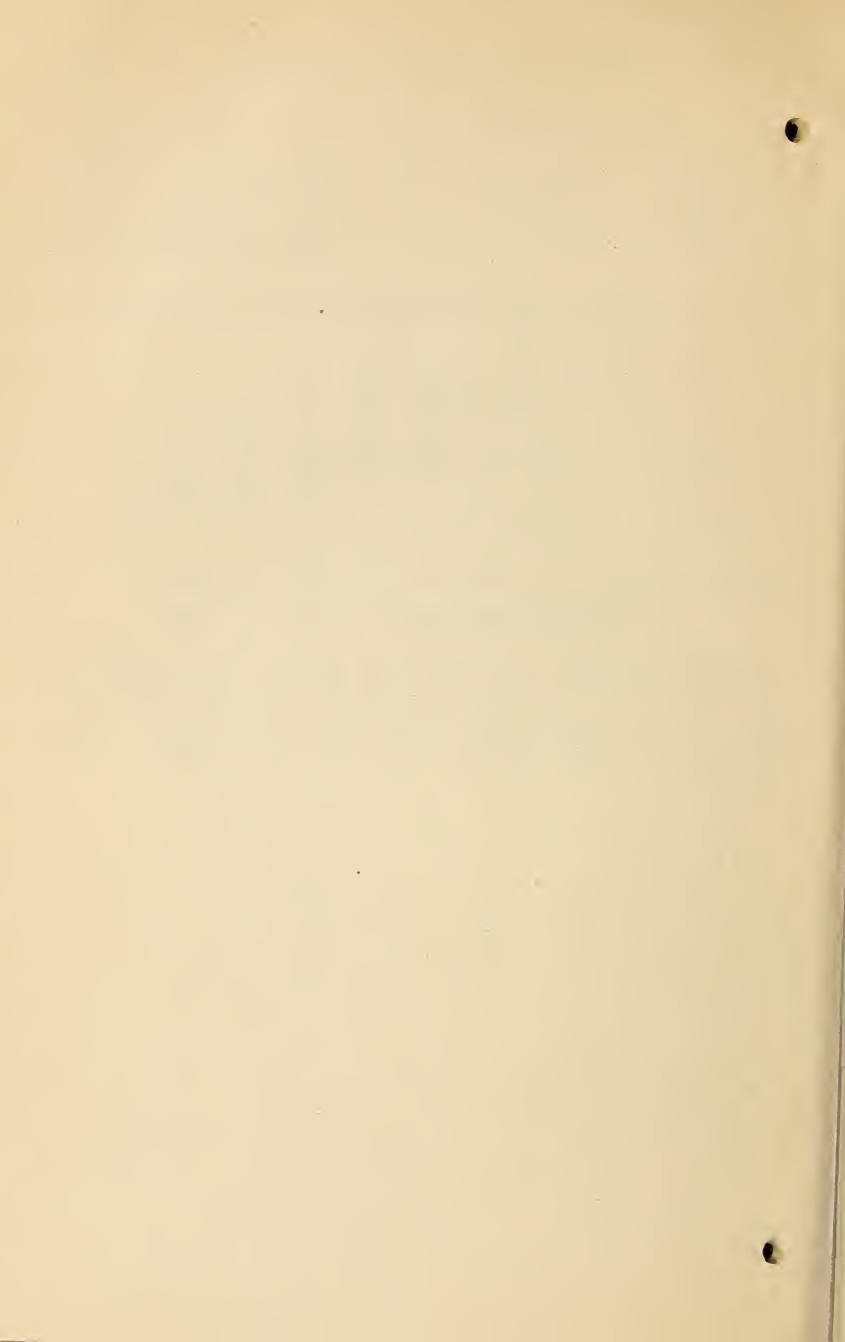
Capacity of silos for various depths of silage

Depth of silage (after settling 2 days)	Capacity of silo having an inside diameter of—									
	10 feet	11 feet	12 feet	13 feet	14 feet	15 feet	16 feet	17 feet	18 feet	20 feet
Feet	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
24	34									
26	38	46	55							
28	42	51	61	71	83					
30	47	56	67	79	91	105				
32		62	74	86	100	115	131			
34			80	94	109	126	143	161		
36			87	102	119	136	155	175	196	
38				110	128	147	167	189	212	261
40					138	158	180	203	228	281
42						170	193	218	245	302
44							207	234	262	323
46								250	280	345
48										368

NOTE.—These figures taken in part from King's Physics of Agriculture.

TO DETERMINE QUANTITY OF HAY IN A RICK

Generally, 512 cubic feet of hay in a stack or mow weigh 1 ton. To determine with reasonable accuracy the number of tons of hay in a rick of average shape, multiply the over—that is, the distance from the ground on one side to the ground on the other—by the width, then the length, and then by 0.37.



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FARMERS' BULLETINS RELATING TO THE FEEDING OF LIVESTOCK

Following are some selected publications dealing with various problems of livestock feeding in much more detail than in this handbook:

- 578. Making and Feeding Silage.
- 655. Cottonseed Meal for Feeding Beef Cattle.
- 724. Feeding Grain Sorghums to Livestock.
- 743. The Feeding of Dairy Cows.
- 840. Farm Sheep Raising for Beginners.
- 873. Utilization of Farm Wastes in Feeding Livestock
- 920. Milk Goats.
- 951. Hog Pastures for Southern States.
- 972. How to Use Sorghum Grain.
- 1030. Feeding Horses.
- 1067. Feeding Hens for Egg Production.
- 1073. Growing Beef on the Farm.
- 1095. Beet-Top Silage and Its By-Products.
- 1133. Feeding Garbage to Hogs.
- 1147. Milo, a Valuable Grain Crop.
- 1158. Growing and Utilizing Sorghum for Forage.
- 1179. Feeding Cottonseed Products to Livestock.
- 1181. Raising Sheep on Temporary Pastures.
- 1229. Utilization of Alfalfa.
- 1336. Feeding and Management of Dairy Cows and Young
 . Dairy Stock.

REPORTS OF EXPERIMENTAL WORK

Experimental work is continually being conducted and the results are reported in Department Bulletins, which are more detailed than Farmers' Bulletins. A list of such reports for various classes of experiments will be furnished on request.

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A PAGE OF CAUTIONS

THINGS LIVESTOCK FEEDERS SHOULD NOT DO

Don't withhold feed from young, growing animals when they want it.

Don't feed a ration containing corn alone to any class of stock.

Don't allow your breeding animals to become so thin that you have to apologize for their condition.

Don't feed milk from tuberculous cattle to your animals.

Don't feed carcasses of animals that have died of disease to any of your stock or chickens.

Don't feed more grain mixture or concentrate than the animal will clean up quickly, except when forcing fattening animals.

Don't allow pregnant breeding animals to become too fat.

Don't use pastures too early in the spring and don't graze pastures too closely.

Don't let animals go thirsty.

Don't forget to salt all animals regularly.

Don't feed animals of different ages and sizes in the same pen or lot.

Don't let strong and aggressive animals rob the weak of the proper amount of feed.

Don't turn cattle or sheep on luxuriant clover when the dew is on.

Don't put fresh feed into dirty or sour troughs.

Don't allow dairy cows and laying hens to become fat.

Don't waste your surplus feeds.

Don't feed frozen, moldy, or spoiled silage.

Don't change an animal's ration abruptly.

Don't feed animals poorly because they are not producing; feed them and give them a chance.

Don't keep scrub and inferior stock; they are wasteful of feed.

BETTER FEEDING OF LIVESTOCK

Great numbers of farmers have expressed to the United States Department of Agriculture their interest in problems of better feeding, growth, and development of livestock.

This handbook has been prepared by department feeding specialists for distribution to farmers who desire a handy-sized set of simple rules and reference tables to be followed in feeding the different classes of farm animals. It aims to aid farmers in understanding the principles of better feeding and in using the best practices which are adaptable to conditions on their farms.

No set of specific feeding rules can be wisely applied throughout the country. Local conditions, seasonal changes, and many other factors combine to make the best feeding practices change from place to place and from time to time. This handbook discusses the main points most commonly encountered in feeding, but which should always be adapted to local conditions. More general discussions of feeding practices will be found in Farmers' Bulletins and other publications of the department, also in publications of the State agricultural colleges and experiment stations.

JOHN R. MOHLER,
Chief, Bureau of Animal Industry.

HOW TO USE THIS HANDBOOK

For general information consult Part I (pages 1 to 12, which deals with the chief everyday problems of livestock feeders.

For directions for feeding the different animals consult Part II (pages 12 to 43), using the index to find the kind in which you are interested.

For weight, measure, composition, and comparative values of feeds and explanation of feeding terms consult Part III (pages 43 to 49).

The index at the back of the handbook lists the entire contents in alphabetical order.